BIOS8003: ASYMPTOTIC STATISTICS

Effective Term
Semester A 2025/26

Part I Course Overview

Course Title
Asymptotic Statistics

Subject Code
BIOS - Biostatistics
Course Number
8003

Academic Unit
Biostatistics (BIOS)

College/School
College of Computing (CC)

Course Duration
One Semester

Credit Units
3

Level
R8 - Research Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
Nil

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract
The course aims to provide students with adequate theoretical background and mathematical tools to access the literature on biostatistics methodologies and applications. Topics covered include: stochastic convergence; delta method; moment

estimator; M- and Z- estimators; Bayes procedures; likelihood ratio tests; chi-square tests; nonparametric estimation; semiparametric inference and efficiency; permutation tests; Bootstrap methods. Selected topics such as empirical likelihood, U-statistics, Bayesian/MCMC methods, EM algorithm, counting process methods in survival analysis, functional data analysis, shape-constrained inference, will also be discussed.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Understand the fundamental concepts in asymptotic statistics	20	x	x	
2	Be familiar with various modes of stochastic convergence	20	x	x	
3	Acquire the techniques of various statistical estimation and testing procedures	20	x	x	x
4	Ability to apply asymptotic analysis techniques in health-related studies	20	x	x	x
5	Effectively communicate and present research findings from the literature	20	x	x	x

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Learning and Teaching Activities (LTAs)

	LTAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lectures	Learning through teaching is primarily based on lectures	1, 2, 3, 4, 5	3 hours/week
2	Assignments	Learning though take-home assignments helps students understand the key concepts and acquire the techniques	1, 2, 3, 4, 5	After class

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks ("-" for nil entry)	Allow Use of GenAI?
1	Assignments	1, 2, 3	30	Help to train students with basic knowledge, concepts, and analysis techniques	Yes

2	Midterm/quizzes	1, 2, 3, 4, 5	20	Test students' capabilities in applying the knowledge to solve relevant problems	No

Continuous Assessment (%)

50

Examination (%)

50

Examination Duration (Hours)

3

Minimum Continuous Assessment Passing Requirement (%)

30

Minimum Examination Passing Requirement (%)

30

Additional Information for ATs

Examination questions are designed to see how well students have achieved the learning objectives and acquired the requisite techniques for problem-solving.

To pass the course, students are required to obtain a minimum of 30% in continuous assessment and a minimum of 30% in the examination.

Assessment Rubrics (AR)

Assessment Task

Assignments (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Problem solving skills

Excellent

(A+, A, A-) Consistently exhibits adept comprehension of asymptotic techniques in statistical theory and applications

Good

(B+, B, B-) Sufficiently applies asymptotic techniques to moderately complex problems

Fair

(C+, C, C-) Demonstrates a moderate understanding of asymptotic techniques to intermediate-level problems.

Marginal

(D) Displays basic grasp of asymptotic techniques to straightforward problems.

Failure

(F) Shows limited comprehension of asymptotic techniques and lacks the ability to apply them to problem-solving

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Assessment Task

Midterm/quizzes (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Problem solving based on comprehensive understanding

Excellent

(A+, A, A-) Exhibits a thorough grasp of asymptotic techniques and effectively applies them to intricate problems

Good

(B+, B, B-) Displays sufficient understanding of asymptotic techniques and effectively applies them to moderately complex problems

Fair

(C+, C, C-) Exhibits a moderate level of comprehension regarding asymptotic techniques and effectively applies them to intermediate-level problems.

Marginal

(D) Shows basic comprehension of asymptotic techniques and applies them to straightforward problems

Failure

(F) Displays limited grasp of asymptotic techniques and lacks the ability to apply them to problem-solving

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Assessment Task

Examination (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Problem solving based on comprehensive understanding

Excellent

(A+, A, A-) Consistently exhibits a deep understanding of asymptotic techniques concepts and effectively applies them to complex problems

Good

(B+, B, B-) Effectively applies asymptotic techniques to moderately complex problems, demonstrating sufficient understanding

Fair

(C+, C, C-) Applies asymptotic techniques to intermediate-level problems with a moderate level of understanding.

Marginal

(D) Applies asymptotic techniques to simple problems with a basic understanding

Failure

(F) Lacks understanding of asymptotic techniques and cannot apply them to problem-solving

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Assessment Task

Assignments (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

Problem solving skills

Excellent

(A+, A, A-) High

Good

(B+, B) Significant

Marginal
(B-, C+, C) Moderate

Failure
(F) Not even reaching marginal levels

Assessment Task
Midterm/quizzes (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
Problem solving based on comprehensive understanding

Excellent
(A+, A, A-) High

Good
(B+, B) Significant

Marginal
(B-, C+, C) Moderate

Failure
(F) Not even reaching marginal levels

Assessment Task
Examination (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
Problem solving based on comprehensive understanding

Excellent
(A+, A, A-) High

Good
(B+, B) Significant

Marginal
(B-, C+, C) Moderate

Failure
(F) Not even reaching marginal levels

Part III Other Information

Keyword Syllabus
Stochastic convergence; delta method; moment estimator; M- and Z- estimators; Bayes procedures; likelihood ratio tests; chi-square tests; nonparametric estimation; permutation tests; Bootstrap methods; U-statistics; Bayesian/MCMC methods; EM algorithm.

Reading List

Compulsory Readings

	Title
1	Nil

Additional Readings

	Title
1	Asymptotic Statistics (Cambridge University Press Series in Statistical and Probabilistic Mathematics), by A. W. van der Vaart.